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Enhancements to the SDAP layer

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Introduction

- The SDAP layer was specified in Release 15 to manage the QoS framework in the 5G core network (based on QoS flows) and the QoS framework in RAN (based on DRBs)
- The SDAP layer provides the minimal functionality needed for
  - Mapping QoS flows and data radio bearers
  - Marking QoS flow ID (QFI)
  - Supporting reflective QoS via RQI marking, and reflective QoS flow to DRB mapping via RDI marking
- With some bells and whistles
  - In-order packet delivery in the uplink via the end-marker control PDU when the mapping between QoS flows and DRBs changes
- Several optimizations were discussed during Release 15 but were not adopted
  - Due to lack of time
- Not much has changed in subsequent releases
  - Except for sidelink related enhancements
- This document
  - Identify key issues that need to be solved

Key Issue #1| Reliability

- Reliable transmission of packets is not guaranteed over RLC UM
  - We expect low latency flows (other than voice) mapped to RLC UM to become increasingly prominent (e.g., for XR)

- Two sources for concern with respect to SDAP
  - Both negatively impact QoS performance

- DL packets carrying RDI marking can be lost
  - Mismatch between NG-RAN and UE on how QoS flows are mapped to (uplink) DRBs

- UL packets carrying end-marker control PDU can be lost
  - gNB will unnecessarily wait for a packet that will never come increasing latency

- Many possible solutions were identified during Release 15

Key Issue #2| Handover

- The SDAP layer has no explicit support for handover

- If multiple QoS flows are mapped to the same DRB in the source and target gNBs, then in-order delivery cannot be guaranteed
  - The associated PDCP entity can only guarantee in-order delivery within a DRB, not within the QoS flows carried by the DRB

- Network implementation can solve the issue only partially
  - For example, by mapping exactly one QoS flow to a DRB
  - Not a scalable solution as the number of QoS flows can be much higher than the maximum number of DRBs that a UE can support
  - Currently the number of DRBs that a UE supports in NR is at most 16, but the maximum number of QoS flows is an order of magnitude larger

- A more scalable and latency sensitive solution is needed

Key Issue #3| UE processing burden

- The stateless nature of the (NAS) reflective mechanism implies that every packet sent from the UPF to the UE is tagged with the Reflective QoS Indication (RQI) and QFI
  - The UE uses these fields together with the Reflective QoS timer (RQ timer) to support Reflective QoS

- The SDAP layer at the UE notifies the NAS layer every time it receives a packet with the RQI bit set
  - Requires the NAS layer to process QoS rules even if the rule already exists
  - In contrast, the AS layer reflective mapping mechanism in stateful

- At high data rates, redundant processing of the RQI bit is inefficient from the UE perspective

- Enhancements to ease UE processing requirements to support reflective QoS would be very beneficial

SDAP enhancements| Proposal

- A WI in Release 18 to enhance the SDAP layer
  - Reliable transmission of RDI marking and end-marker PDU
  - Support of handover
  - Reduce UE processing burden for supporting reflective QoS

- A short study phase can precede the normative phase
  - Focus on solutions that have been discussed in past releases

- Can liaise with SA and CT groups as necessary, but expect minimal impact to their specifications

- Lead WG: RAN2

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